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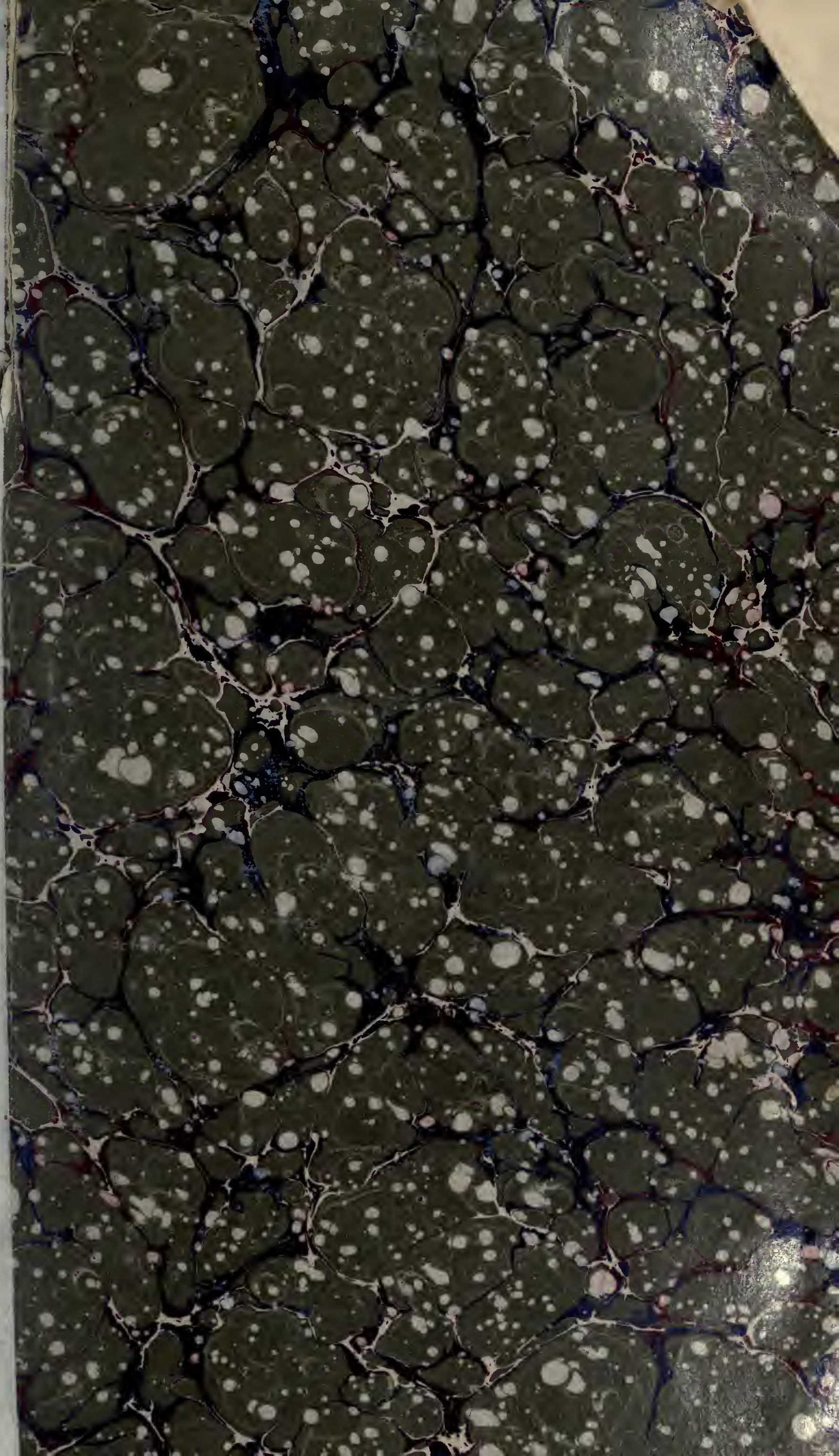

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CONTENTS OF THIS NUMBER:

ASA GRAY: HIS LIFE AND WORK

BY

MRS. MARY TREAT

AUTHOR OF "HOME STUDIES IN NATURE," "MY GARDEN PETS," "THROUGH A MICROSCOPE," ETC.

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> *The eye reads omens where it goes,*
> *And speaks all languages the rose;*
> *And, striving to be man, the worm*
> *Mounts through all the spires of form.*
> —*Nature*, i., 7.

THE fossil strata show us that Nature began with rudimental forms, and rose to the more complex as fast as the earth was fit for their dwelling-place; and that the lower perish as the higher appear. Very few of our race can be said to be yet finished men. We still carry sticking to us some remains of the preceding inferior quadruped organization. . . The age of the quadruped is to go out,—the age of the brain and of the heart is to come in. And if one shall read the future of the race hinted in the organic effort of Nature to mount and meliorate, and the corresponding impulse to the Better in the human being, we shall dare affirm that there is nothing he will not overcome and convert, until at last culture shall absorb the chaos and gehenna. He will convert the Furies into Muses and the hells into benefit.—*Culture.*

—RALPH WALDO EMERSON.

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XVI.

Brooklyn Ethical Association Lectures.

ASA GRAY: HIS LIFE AND WORK

BY

MRS. MARY TREAT

AUTHOR OF "HOME STUDIES IN NATURE," "MY GARDEN PETS,"
"THROUGH A MICROSCOPE," ETC.

BOSTON:
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1890

COLLATERAL READINGS SUGGESTED.

"In Memoriam—Asa Gray" (University Press, 1888); "Sketch of Asa Gray," in *Am. Journal of Science*, Vol. 35, March, 1888; Article, "Asa Gray," in "Appleton's Cyclopædia of Biography," also article in "American Cyclopædia."

ASA GRAY: HIS LIFE AND WORK.*

Now and then a man arises whose life and works are of such magnitude that he shapes the intellectual growth of a nation or a civilization, moulding and turning thought into a new channel. Charles Darwin, like Copernicus, advanced such revolutionary doctrines. As Copernicus taught the world the now received system of astronomy, so Darwin has taught the origin of species by Natural Selection. Before Copernicus the world did not move — it was permanent, fixed, central. So before Darwin the species which exist on the earth were regarded as permanent and fixed, each having been produced by a special creation. But this belief is fast disappearing, and we are living to see Darwin's teachings recognized — not by the slow process by which the Copernican system came to be accepted, but with rapid strides due to the advanced thinkers of our time, who see and grasp the "new thought" as men could not do in the time of Copernicus.

Copernicus drew upon himself and his theory the condemnation of the Church of Rome, which was not obliterated until 1821, two hundred and eighty-seven years after it was issued! And Galileo, who followed Copernicus a century later, was imprisoned in the cells of the Inquisition for teaching the heretical doctrine that the earth moves. Surely the world has advanced during the past four centuries, so that in our time "heresy" simply meets with disapproval and ridicule.

It is not so many years since the Darwinian theory was first promulgated, that we cannot remember the fierce opposition and ridicule with which it was received, both by the pulpit and the press. Then, it needed courage and boldness to be its advocate. In this country, one of its earliest disciples was Asa Gray, who bravely stepped to the front of the battle and made havoc in the ranks of Darwin's

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opposers, until, largely through his influence, there came to be a wide-spread recognition of the doctrine of Evolution among the leading representatives of biological science. Indeed, we may say that at the present time this recognition is practically universal.

Asa Gray was born on the 18th of November, 1810, in Oneida County, New York, a few miles south from Utica. He was the eldest of eight children, and from his earliest years a wide-awake, active child, energetic and studious, winning the prize of a spelling-book before he was three years of age. When six and seven years old he was the champion speller in the district school. Following him along in his boyhood we learn that, when eleven years of age, having exhausted the district-school at home, he was sent to a grammar-school in Clinton, where he staid two years, and then entered Fairfield Academy, where he remained until his father desired him to leave the Academy and enter the Fairfield Medical School. This was in the winter of 1826–27. He finished his medical course and received his degree of Doctor of Medicine in the spring of 1831.

While in this Medical School — in the winter of 1827–28 — his attention was aroused in botany by reading an article in the "Edinborough Encyclopædia." He soon obtained Eaton's Botany, which he studied with increasing interest through the Winter, and longed for Spring that he might test his knowledge in consulting the flora around him. When Spring came we can imagine something of the delight with which he hailed his first treasure, the little *Claytonia Virginica,* which he found no difficulty in assigning to its proper place. A new world was now opened around him, and from this time on he saw not as others see. Things were revealed to him that were blindly passed by the world at large. So he became eyes to the blind and a medium of knowledge to many loving followers.

Although he received his degree of Doctor of Medicine, and no doubt would have been a shining light in the world of medical science had he chosen the career of physician, his heart was not there; it was set on the trees and flowers, the growing things around him, and his far-reaching mind grasped the hidden secrets of Nature which he unveiled to countless numbers of disciples.

In 1834 he became connected with Dr. John Torrey, which resulted in a close relationship and a life-long friendship. For a time he studied botany under Dr. Torrey, but he soon made such rapid strides that he was no longer under but with him in united labor. Together they botanized in northern New York and in the Pine-barrens of New Jersey. In the same year he became Dr. Torrey's assistant in the Chemical Laboratory in the College of Physicians and Surgeons in New York City. But he remained in this Medical School only a year or so, as it was not on a sufficiently flourishing financial basis to warrant Dr. Torrey in continuing to employ an assistant. Torrey was instrumental, however, in securing for him the appointment of Curator in the Lyceum of Natural History in New York, so that his botanical work was continued under the inspiring influence of Dr. Torrey for the next four or five years.

In his twenty-fifth year he issued two volumes on the grasses and sedges, each describing a hundred species, and illustrated by dried specimens. Among the grasses was one new to science, *Pancicum Xanthophysum*, which was the first of the thousands of unknown species afterward named by him. In 1836 he began his contributions to the *American Journal of Science*, which he continued for more than fifty years, and he also became one of the editors of this journal, which place he filled for thirty-five years. About this time (1835–36) he commenced the preparation of the "Elements of Botany," which he published in 1836. This work was characterized by such a vigorous style and breadth of treatment that it at once attracted the attention of scientists, and paved the way for universal recognition by the great botanists of Europe whom he visited in 1838. This visit was made necessary to enable him to go on with the "North American Flora," of which he was, at that early age, joint author with Dr. Torrey. Young as he was, hearts were opened and hands held out to him by such men as Robert Brown, De Candolle, the elder Hooker, Lambert, Bentham and Lindley, at that time the leading botanists of Europe. He also met the younger Hooker, then a medical student in Glasgow, and here the foundation was laid for their life-long friendship. Hooker, no less than Gray, was destined to become one of the leading scientists of his time — a great explorer and author, and President of the Royal Society. He also followed his illustrious father as Director of the Royal Gardens at Kew, which position he still holds.

In this brief sketch it will be impossible to follow Dr. Gray closely in his travels, or to enumerate the great men he met during the year he remained abroad. But he returned home full of inspiration, with enlarged views, and well equipped for the work he had in hand. In the *American Journal of Science* (April, 1841) he published a very interesting article, giving an account of the herbaria he examined during this visit, commencing with that of Linnæus, which is told in such a happy manner that it cannot fail to interest all lovers of good reading. In 1842, the Fellows of Harvard College offered him the Fisher Professorship of Natural History, which had just then been founded under the will of Dr. Fisher. At the time of Dr. Gray's appointment there was no botanical library and no herbarium in the College, and the botanical garden was hardly more than a name. What are they to-day— the magnificent library, the great herbarium, and the garden! Had Dr. Gray done nothing more for the advancement of science than the building up of these, this alone would have made him immortal.

The same year that he was made Professor in the College he published his botanical text-book, "Structural and Systematic Botany," which was by far the most comprehensive and valuable work on botany that had appeared in our country. It has passed through six editions, each improved and almost wholly re-written. The last edition, published in 1879, was entirely re-written. In 1848 his "Manual of the Botany of the Northern United States" was printed. For more than thirty years this book has been without a rival. It has been the text-book for all botanists in the Eastern, Middle, and Northern States east of the Mississippi. It is so plain and simple in its language that anyone with a natural love of plants needs no other instructor to enable him to become well-versed in the flora of these regions. The influence that this book has wrought in schools and among the people, in arousing an interest in botany, is beyond calculation. It has passed through five editions and several issues. In the first edition he expresses his gratitude to Dr. Torrey in the following inscription:

TO
JOHN TORREY, M.D.,
Corresponding member of the Linnæan Society, &c.,
THIS VOLUME IS DEDICATED BY THE AUTHOR,
In grateful acknowledgment of the friendship which has honored
and the counsel which has aided him
from the commencement of his botanical pursuits.

The last edition was published in 1867. This also bears testimony of his continued love and hearty friendship for Dr. Torrey, in the following dedicatory note:

TO
JOHN TORREY, L.L.D.

Almost twenty years have passed since the first edition of this work was dedicated to you,—more than thirty, since, as your pupil, I began to enjoy the advantage of being associated with you in botanical pursuits, and in a lasting friendship. The flow of time has only deepened the sense of gratitude due to you from your attached friend, ASA GRAY.
CAMBRIDGE, May 30, 1867.

This was characteristic of Asa Gray — he was a steadfast friend, giving and winning affection wherever he went, always acknowledging the helpfulness of others, and often magnifying such assistance.

His "Field, Forest, and Garden Botany," published in 1868, is an admirable guide for the beginner for determining the common cultivated plants as well as the native ones. In order to bring it within the compass of a common-school text-book, it was necessary to condense the descriptions of the wild plants, and to leave out altogether the most rare and obscure ones. This is no detriment to the beginner,—rather an advantage, when he has the Manual to follow. Even with all its condensation it contains descriptions of 2650 species, belonging to 947 genera. And the "Lessons in Botany and Vegetable Physiology," which preceded it, with over three hundred original illustrations from Nature by Isaac Sprague, has often been re-written and improved until made so perfect that seemingly no other book could be made that would be so admirably adapted to our needs.

We must not overlook two other charming little books, "How Plants Grow," first published in 1858, and "How Plants Behave," in 1872. These were written for young people; but many grown people have greatly enjoyed them and drawn inspiration from their pages.

But the greatest of all of Dr. Gray's botanical works is his "Synoptical Flora of North America," two parts of which have been published,—"the first in 1878, being the first part of Vol. II., Gamopetalæ after Compositæ, that is, the portion immediately following the second volume of the 'Flora' of Torrey and Gray; and the second, in 1884, covering the ground (Caprifoliaceæ to Compositæ inclusive) of the second volume of Torrey and Gray's 'Flora.' The middle half of the entire Flora is thus completed. These volumes contain eight hundred and fifty closely printed pages, and it required ten years of excessive and hardly interrupted labor to complete them. They are masterpieces of clear and concise arrangement and of compactness and beauty of method. There will hardly be found in any work of descriptive botany a greater display of learning, clearness of vision and analytical powers; and few works of systematic botany have ever treated of a broader field."*

When we consider how much of the work on nearly all of these educational books—with the exception of the "Flora"—was accomplished while Dr. Gray scrupulously performed all of his college duties, we get some idea of the magnitude of the man.

His writings and influence have done as much toward the advancement of general science, and especially toward the growth of the doctrine of Evolution, as his text-books have done for the advancement of botany. One of his earliest papers, showing the tendency of his mind in the direction of evolution, was his observations upon the "Relations of the Japanese Flora to that of North America." I will quote what his colleague, Professor C. S. Sargent, says of this work:

> In 1854 he published the "Botany of the Wilkes Exploring Expedition," a large quarto volume, accompanied by a folio atlas containing a hundred magnificent plates; and in 1859 he read his paper, afterward published in the "Memoirs of the American Academy of Arts and Sciences," upon the "Diagnostic Characters of Certain New Species of Plants, collected in Japan by Charles Wright, with observations upon the Relations of the Japanese Flora to that of North America, and of other parts of the northern temperate zone."
>
> This is Professor Gray's most remarkable contribution to science. It at once raised him to the very highest rank among philosophi-

---

* From a sketch of Dr. Gray in the *New York Sun* of January 3, 1886, by Professor C. S. Sargent.

cal naturalists, and attracted to him the attention of the whole scientific world. In this paper he first points out the similarity between the floras of Eastern North America and Japan, a fact he had long suspected, and then explains the peculiar distribution of plants through the Northern Hemisphere, by tracing their direct descent through geological periods from ancestors which flourished when there was a tertiary vegetation. This theory of geographical distribution, now generally adopted by all naturalists, was further elaborated in his lecture upon "Sequoia and its History," delivered in 1872 before the American Association for the Advancement of Science, and still later in a lecture entitled "Forest Geography and Archæology," delivered in 1878 before the Harvard Natural History Society.

These studies of the flora of Japan had doubtless greatly modified Professor Gray's opinion upon the origin of species, a subject which was just then beginning to deeply interest the intellectual world. He, like the younger De Candolle and Hooker, was now ready to admit the doctrine of the local origin of vegetable species, and to discard the hypothesis of a double or multiple origin, at that time and long afterward adhered to by many botanists. That is, he believed that two similar or closely allied species of plants, the one, for example, growing in New England and the other in Japan, were descended from one common although remote ancestor, and that they were not, as Schouw and Agassiz insisted, created separately and independently in the regions where they now exist.

Dr. Gray more than any other man in America has made the doctrine of Evolution what it is to-day; and he has made Darwin better understood and appreciated than all other writers combined. And yet he did not wholly agree with Darwin in some particulars. In a letter to Dr. Gray, Mr. Darwin says, "I grieve to say that I cannot go as far as you do about design. I cannot think the world as we see it is the result of chance, and yet I cannot look at each separate thing as the result of design." But Dr. Gray was so deeply grounded in the Christian faith that nothing could swerve him. He believed that the Darwinian theory of the origin of species was entirely reconcilable with the conception of a Divine Power governing the universe. He believed "that each variation has been specially ordained or led along a beneficial line."

In the closing paragraph of an address delivered before the American Association for the Advancement of Science, in 1872, on "Sequoia and its History," he touches the keynote of his religious belief. After quoting Miss Frances Power Cobbe's regrets that we no sooner find out how anything is done, than our first thought is that God did not do it, he agrees with her that this conclusion is unworthy — "nay more, deplorable." Then follows these brief, vivid words: "Through what faults or infirmities of dogmatism on the one hand and skepticism on the other it came to be so thought, we need not here consider. Let us hope, and I confidently expect, that it is not to last; that the religious faith which survived without a shock the notion of the fixity of the earth itself, may equally outlast the notion of the fixity of the species which inhabit it; that in the future even more than in the past faith in an order which is the basis of science will not — as it cannot reasonably — be dissevered from faith in an Ordainer, which is the basis of religion."

In 1876 Dr. Gray brought together his various papers on Evolution and kindred subjects, which had appeared in the *American Journal of Science*, the *Nation*, and the *Atlantic Monthly*, and published them in a book, under the title of "Darwiniana." In the preface to this book he defines his religious belief in a short, clear passage, where it stands to remind us that one of the greatest men of the age found no difficulty in harmonizing the "new thought," or Evolution, with Christianity: "I am scientifically and in my own fashion a Darwinian, philosophically a convinced theist, and religiously an acceptor of the creed commonly called the Nicene, as the exponent of the Christian faith."

His contributions to Evolution, and his views on the subject, are better known to the world at large than "his rank and position as a teacher of natural science." He was a born teacher. He drew students to him by his kindly, genial nature. His interest in their work was a remarkable trait in his character. His correspondents felt his friendly influence permeating their lives, giving them fresh impulse and inspiration in their work. Even students whom he had never met were cordially and most heartily given any assistance in his power, in the way of suggestion and even in mapping out methods of work for them to follow. During all the years of his busy life, helpful, suggestive letters were written with his own hand, encouraging students to go on with their work and publish its results. But for him, the work of many a botanical student would never have been known.

Having access to some of his letters to a correspondent, I have been looking them over with a view to giving a few extracts to illustrate his manner of guiding and instructing. The correspondent had a little plat of ground under observation, which had never been disturbed by man further than in the cutting away of the underbrush and part of the trees; Dr. Gray was given a list of the herbaceous plants that were growing on the spot, and here is his reply:

> Your letter of the 12th, so full of interest, was followed this evening by the box, which I wait for daylight before opening. But I will not delay most hearty thanks for your very kind attention to my requests. I am dreadfully pressed with work now, being on the eve of completing a new lecture-room and cabinet, laboratory, etc., here in the Garden, and many things and various workmen have to be looked after, so that I cannot sit down till night, and then am tired enough. . . .
>
> Your lawn flora is very interesting. Now, you would do a good thing if you would keep a record of this, and next year note any changes—i. e., any overcome, or any new-comers. And so on year after year. I anticipate many changes. But as it is, it illustrates Darwin's remark upon the advantages of diversity. You have vastly more vegetation on the space than could be if restricted to one or few species.
>
> There are a good many plants on your lawn which I would gladly have in our Garden. . . .
>
> No, I have not *Xerophyllum*, nor the lovely *Pyxidanthera.* I tried both once, and lost them, but I long to try again. Will you help me to them in early Spring? What did your Penn Yan friend do to make *Pyxidanthera* grow?
>
> Writing of these plants brings back most vividly my pine-barren botanizing of 30 to 35 years ago! . . .

The above letter was soon followed by another, showing his interest in the correspondent's observations on *Drosera.* It was understood between Dr. Gray and his correspondent that either could use what the other had written about *Drosera* and other plants. In one of the letters before me Dr. Gray says, "You can use anything that I say about *Drosera* for publication, and I want the same privilege."

> . . . About the *Drosera longifolia* (which the species you describe certainly is). The *folding* of the blade of the leaf itself around the insect, which I understand you to describe, is very interesting, and I have copied your statement for publication. . . .
>
> I wish I had a pencil-sketch of this fly-catching. . . .
>
> I am preparing a new edition of "How Plants Grow,"—with three new chapters,—*viz.*,
>
> How Plants move, climb, and take positions.
>
> How Plants employ Insects to work for them.
>
> How certain Plants capture Insects.

This leads me to ask, Have you any butterflies or moths with orchid pollen-masses attached to head or eye? . . .

Platanthera Ciliaris,—how I wanted it last Summer! If you could find it now—roots, even, would delight me. . . .

More than a year after the above letter was penned, we find his interest still continued in *Drosera:*

Thanks for the plants which came in nice order. . . .

In Spring, as soon as they can be found, I want some bulbs of *Drosera filiformis*, and that you should also make some observations which Darwin wants to be made. But he will write to you.

Two years later he writes about another insectivorous plant:

Thanks for yours of Dec. 2. . . .

The *Tribune* will be glad to have your article about Bladderwort, pending. As usual, Darwin is ahead of you. But he has published nothing yet, only hints have appeared—and he will be pleased that you have hit on it. If you prepare an article for the *Tribune* I would have some drawings made to show the bladders in wood-cuts.

Always call on me, if I can aid in any way. Dear Dr. Hooker (Kew) has lost his wife suddenly.

Still later, he is interested in the Florida *Pinguiculas*, and writes under date of March 6, 1877:

Those *Pinguiculas* around you are such nice things for their way of cross-fertilizing that I hope you are studying them and seeing what insects *do it*. . . .

Again on March 16, 1877:

Well, if that little Hymenopter is the right one, his tongue will be long enough to reach from the top of the spur (bottom of sac) down to the nectar. Please catch and send me one or two, or more, and I will find his name.

Pray work up an article on these *Pinguicula*.

A bee would fertilize much better than a butterfly, if he could get in—as you will see on looking.

What do you say? Shall I send you the "Darwiniana" book, or wait till you come North? . . .

On May 14th of the same year this paragraph occurs in another letter: "As to *Pinguicula*, I have had Sprague make good outline-sketches and dissections to show the most, and have laid them up for *future use*—yours and perhaps mine. . . . The printer keeps me awfully busy."

Interested as he was in these insectivorous plants, and especially in Darwin's work, helping him by directing observations on this side of the water and furnishing him directly with material for his forthcoming work on "Insectivorous Plants," yet when the book appeared he was for a long time too busy to read it:

> *Herbarium of Harvard University*,
> Botanic Garden, Cambridge, Mass., 29 July, 1875.
>
> You will hardly credit it—that I have had Darwin's book for a fortnight and have not yet found time to read over twenty or thirty pages. That shows you how busy I am, and with much less interesting work—but work that is both necessary and pressing.

We can now better understand why Asa Gray was so universally honored and loved by such a wide circle of students and botanists, as well as by many distinguished men in other departments of science. With all his multifarious work, he was ever the kind helper and teacher. Professor Sargent tells us that "he was a foreign member of the Royal Society of London; he was a foreign member also of the Institute of France, one of the 'immortal eight'; and long ago he was welcomed into all the less exclusive bodies of European savants. He served the American Academy of Arts and Sciences as its President, presided over the American Association for the Advancement of Science, and was a regent of the Smithsonian Institution." On his seventy-fifth birthday the botanists of our country united in sending him messages of affection and esteem, accompanied by a silver vase. The *Botanical Gazette* of December, 1885, tells the story of the presentation, and gives a description of the vase as follows:

> The vase "is about eleven inches high, exclusive of the ebony pedestal, which is surrounded by a hoop of hammered silver, bearing the inscription,
>
> 1810 November eighteenth, 1885
> ASA GRAY
> in token of the universal esteem
> of American Botanists.
>
> "The lower part of the vase is fluted and the upper part covered with flowers. The place of honor on one side is held by *Grayia Polygaloides*, and on the other by *Shortia galacifolia*. On the *Grayia* side of the prominent plants are *Aquilegia Canadensis*, *Centaurea Americana*, *Jeffersonia diphylla*, *Rudbeckia speciosa*, and *Mitchella repens*. On the *Shortia* side there are *Lilium Grayi*, *Aster Bigelovii*, *Solidago serotina* and *Epigæa repens*. The lower part of the handles runs into a cluster of *Dionæa* leaves, which clasps the body of the vase, and their upper parts are covered with

Notholæna Grayi. *Adlumia cirrhosa* trails over the whole background, and its leaves and flowers crop out here and there. The entire surface is 'oxidized,' which gives greater relief to the decorations. The vase was designed by L. E. Jenks, and the chasing was done by Wm. J. Austin, both with Bigelow, Kennard & Co. The heartiest praise has been bestowed upon the design and the workmanship by all who have seen it.

"By the request of the committee, greetings in the form of cards and letters had been sent by those who gave the vase. These were placed on a simple but elegant silver plate and accompanied the gift. The inscription on the plate reads :

Bearing the Greetings of
One hundred and eighty Botanists
of North America, to
ASA GRAY,
On his Seventy-fifth Birthday,
November 18th, 1885.

"The expressions of affection and respect which are contained in letters to the committee as well as those which were presented to the good Doctor, together with the united and hearty response to the Committee's suggestion, all testify how universal is the esteem and how deep is the affection for this genial man, whom we have thus delighted to honor."

The following response was sent by Dr. Gray :

Herbarium of Harvard University,
Cambridge, Mass., November 19, 1885.

To J. C. Arthur, C. R. Barnes, J. M. Coulter, Committee, and to the numerous Botanical Brotherhood represented by them :

As I am quite unable to convey to you in words any adequate idea of the gratification I received on the morning of the 18th inst., from the wealth of congratulations and expressions of esteem and affection which welcomed my seventy-fifth birthday, I can do no more than to render to each and all my heartiest thanks. Among fellow-botanists, more pleasantly connected than in any other pursuit by mutual giving and receiving, some recognition of a rather uncommon anniversary might naturally be expected. But this full flow of benediction from the whole length and breadth of the land, whose flora is a common study and a common delight, was as unexpected as it is touching and memorable. Equally so is the exquisite vase which accompanied the messages of congratulation and is to commemorate them, and upon which not a few of the flowers associated with my name or with my special studies are so deftly wrought by art that of them one may almost say, "The art itself is nature."

The gift is gratefully received, and it will preserve the memory to those who come after us of a day made by you, dear brethren and sisters, a very happy one to

Yours affectionately, ASA GRAY.

Dr. Gray's correspondence with Darwin dates from 1855, commencing with a request of Darwin for a list of American Alpine plants. From this time on their correspondence continued, and their friendship was close and intimate until Mr. Darwin's death, as is shown in "Darwin's Life and Letters," and also in Dr. Gray's printed writings.

In 1885, Dr. Gray's portrait was made in bronze by St. Gaudens, and presented to Harvard University. But one of the best pictures that has been left to us was taken while he was on a botanical excursion in the Rocky Mountains. It represents a group of botanists in camp on Veta Pass, 9000 feet above the sea. Dr. Gray sits on the ground beneath the trees, with uncovered head, holding evidences of his work in a well-filled botanical press. Sir Joseph Hooker is by his side, with freshly gathered plants in his hand. Mrs. Gray is at the table dispensing tea to Dr. Hayden, Dr. Lamborn, Stevenson, and other distinguished members of the party. It is a vivid, life-like scene — a picture cherished by many.

But Asa Gray's memory will be perpetuated and cherished without the aid of pictures,—it is forever associated with natural objects more enduring than the monumental shaft. The loftiest peak of the Rocky Mountains bears his name, and many lowly plants in the vales commemorate it, breathing it anew in their annual resurrection. These will keep his memory fresh through the ages to come. His work and deeds can never die. Our own poet of Nature has said of Truth, "The eternal years of God are hers." All the labors and all the thoughts of Asa Gray were consecrated to the discovery and service of the Truth — and by this loving constancy of devotion they are assured an immortality of beneficent influence.

ABSTRACT OF THE DISCUSSION.

Miss Eliza A. Youmans :—

In Mrs. Treat's admirable account of Prof. Gray's intellectual career she has given the simple facts concerning the times at which his various works were published, and the exalted estimate put upon them both at home and abroad. The "North American Flora," however, she pronounces his most important work, and her account of his labors upon it seems to require further explanation. The first volume, she says, appeared in 1840, the second in 1843, and the next instalment not until 1878, after an interval of thirty-five years. As its discontinuance dates from the time of his acceptance of the Fisher Professorship of Natural History in Harvard College, and its resumption immediately followed his release from official duties, which, I learn, took place in 1873, giving him five years for the preparation of the volume of 1878, the quite natural inference would be that his official work left him no time to give to the preparation of the "Flora." But we are debarred from this conclusion by the detailed and emphatic statements of Mrs. Treat concerning the vast amount of labor he did outside his college duties. His text-books and manuals were all done in the evening, and at odd hours; and his labors as a critic consumed a great deal of time. He was so familiar with all sides of the scientific questions bearing upon his specialty, so just and discriminating and candid, that his opinions, criticisms and advice were eagerly sought for. His Reviews, Book-notices, and Biographical sketches are almost endless.

In the introduction to the two volumes of the "Scientific Papers of Asa Gray, selected by Charles Sprague Sargent," the compiler says: "The selection of articles of his for re-publication has been an embarassing and difficult task. The amount of material at my disposal has been overwhelming; and desirable as it might be to republish it all, it has not been possible to do so within reasonable limits. More than eleven hundred bibliographical notices and longer reviews were published by Prof. Gray in different periodicals, and it was necessary to exclude a number of papers of nearly as great interest as those which are chosen." Clearly, then, it was not lack of time that kept Dr. Gray from going on with the "Flora." Why then, in the name of Botanical science if not of common sense, did not Prof. Gray, during these years, spend the time saved from official duties in carrying on the great work on which his heart was set; which he alone of all men was by nature and culture so fitted to execute, and which was so strenuously called for by the world of science? Why was its resumption postponed till the later years of life, so that his eyes were not permitted to behold its final accomplishment? According to Mrs. Treat, "he had carried it on to the conclusion of the middle half of the entire Flora," and there it is left for other hands to finish. Or, may we not reasonably ask, why was it postponed at all? It was evidently not in the plan of Mrs. Treat's paper to raise questions or to answer them. But I have in my possession an explanation of this seeming difficulty. It was given by that great scientific explorer and life-long friend of Prof. Gray, Sir Joseph Hooker, and it furnishes matter for serious reflection. In the summer of 1871, just two years before Prof. Gray was relieved from college duties, and while men of science were impatient and aggravated at his situation, Mr. E. L. Youmans, who was then in London busy in establishing the "International Scientific Series," received a note from Dr. Hooker asking him to come over to Kew and dine with him, as he was quite alone. Mr. Youmans was on the lookout for eminent scientists to write books for the series, and while at dinner the talk ran upon men of this class. The next day Mr. Youmans gave an account of his visit in a letter to his New York correspondent, and the pertinence to this subject of Dr. Hooker's remarks, as reported in this letter, will, I think, justify the liberty I take in repeating them here.

The allusion to Prof. Gray's situation was suggested by the talk concerning Mr. Spencer. Dr. Hooker and Mr. Youmans had been discussing one and another great man, when Dr. Hooker said: "Spencer is the mighty thinker among them; and he is all right now. The recognition of his genius is complete. What a lucky thing it was that he failed in getting an official appointment when he began his philosophy. Had he succeeded we never should have heard of the philosophy. The things are absolutely incompatible. No man can do *great original work* and be hampered with the cares of a position. The thing is impossible. The work must have the whole man. That is why I have tried to get Gray free. You Americans don't know how much of a man Gray is; but he is hampered with students' work and is not able to keep an assistant. When you were working for Spencer on the other side, I was working for Gray here. I thought I had got it arranged. I obtained a promise from Peabody to give money enough to relieve Gray and let him go on with *original work;* but when he got over there, they worked at him and defeated all the good of the plan."

Happily, two years later, Gray was made free, and began again his "North American Flora," which is at every step and in all its details a work of original research. There is only now and then a man who is capable of carrying on original investigations in any branch of science. Successful research implies an accurate acquaintance with pre-existing knowledge in the field to be explored. It demands keen logic and cool judgment, and not these alone. People with great learning, fine reasoning powers and high judicial faculty are not so very rare. But the original investigator, the discoverer of principles and of laws, must have, joined with these weighty elements, the gift of a lively imagination. Prof. Gray was such a man, and Dr. Hooker and Mr. Bentham, along with him — the great leaders and originators in botanical science in our day — are men of this order. Let me give you an example of the estimate put upon this faculty by a botanist who knows.

Prof. Sachs, in his masterly sketch of the development of botany from 1530 to 1860, says: "I have made it my chief object to discover the first dawning of scientific ideas, and to follow them as they developed into comprehensive theories. But the task is a very difficult one, for it is only with great labor that the historian of Botany succeeds in picking the real thread of scientific thought out of an incredible chaos of empirical material. It has always been the chief hindrance to a rapid advance in Botany that the majority of writers simply collected facts, or if they attempted to apply them to theoretical purposes, did so very imperfectly. I have therefore singled out those men as the *true heroes* of science, of, our story, who not only established new facts, but made a speculative use of empirical material"; and he describes this speculative process in gifted minds as "an ever-deepening insight into the relationship of all plants to one another; into their outer form and inner organization, and into the physiological processes dependent on these conditions."

Prof. Gray's original work proves him to have been one of these *true heroes* of the botanical story. He was a scientific theorizer. He could make a speculative use of facts. He was a deep thinker seeking always for the most comprehensive points of view. For instance, Mrs. Treat says that his most remarkable contribution to science was a paper prepared in 1859 upon the "Diagnostic characters of certain new species of plants collected in Japan by Charles Wright; with observations upon the relations of the Japanese Flora to that of North America and other parts of the northern temperate zone." "This paper," she says, "at once raised him to the very highest rank among philosophical naturalists, and attracted to him the attention of the whole scientific world."

Here, certainly, was very different work from that required in making text-books and teaching college students. It called into action his highest powers. He was dealing with the relationships of widely separated patches of our North American Flora and the Flora of eastern Asia, between which he had discovered an unaccountable likeness. And then he also found a likeness between these existing Floras and that of the Tertiary epoch. Think of the vast stores of accurate knowledge required to establish these relationships! But the man of imagination does not stop with the facts. The why and the how are ever pressing for answers, and here comes in the scientific imagination. Mrs. Treat says: "He explained the peculiar distribution of plants through the Northern hemisphere by tracing their descent through geological periods from common ancestors that flourished in the Tertiary epoch in high latitudes." And this was done before Darwin. No wonder that men of science abroad were impatient at the sight of this mental giant grinding in the class-room and spending his precious leisure in editorial drudgery or the manufacture of text-books, however perfect.

There is another aspect of the situation which makes it seem still more aggravating. This man's work had been accumulating for a hundred years. Not only had he come to an unexplored continent, but the principles by which its Flora could be naturally classed were not established until his time; and he had an important hand in their establishment. From the time of Linnæus, thinking Botanists had been bewildered and defeated by the contradiction between the dogma of the fixity of species and the aspects presented by the discovered facts of the vegetal world. Such natural groups of plants as mosses, ferns, Coniferæ, Umbiliferæ, Compositæ, Labiatæ, Papilionaceæ, were recognized. These groups were seen and felt, as we see and feel the groups of birds, reptiles, etc., in the animal world. Even Linnæus believed in a natural system of classification founded on constitutional resemblances. Here and there, while artificial classification held the field, a few European botanists of deeper insight pondered over the natural relationships of plants, and by the comparative study of mature forms arrived at the science of morphology, which was soon greatly advanced by the microscope; and the anatomy and physiology of plants were also studied with effect. A long series of relationships among plants was worked out with great clearness, but they were all characterized by that mysterious word "affinity," and here thought mostly ended. The idea of the symmetry of plants was reached by these deeper students; and mingling metaphysics with objective studies, the notion of *types* in the vegetal world was conceived. By the help of theological conceptions, the plan of creation, it was thought, had been discovered by Naturalists, who readily took the next step of regarding the objects of Nature as the thoughts of the Creator—a view made familiar to us thirty or forty years ago by Prof. Agassiz.

Owing to this state of things philosophical botany made slow progress, and only the most gifted minds could evolve correct principles available in classification. Prof. Torrey was a man of the required stamp, but he came a little too soon. Prof. Gray's study of Japanese vegetation brought him to conclusions concerning the fixity of species that made him one of Darwin's most able advisers in the years preceding the issue of the "Origin of Species." With the Flora of a continent to be studied in the light of recent discovery it seems doubly deplorable that the thirty-five most productive years of Prof. Gray's life should not have been spent in original research under the most favorable conditions.

Prof. Gray's case is only one of many in which men of great powers, anxiously seeking to use them to the world's advantage, have been compelled to spend their lives in drudgery, and to die with their great work unaccomplished. The world must continue to suffer the loss of such knowledge as Asa Gray might have added to its stock. And the need of some method of discovering master-minds, and presenting them as candidates for support to those who are anxious to contribute to the advance of knowledge, is forcibly suggested by this history.

DR. LEWIS G. JANES:—

The nature of Dr. Gray's contribution to the doctrine of Evolution may perhaps be best understood by taking a single example, explanatory of his theory of the geographical distribution of plants. It is found that the nearest extant relations of the great sequoias, or red-wood trees,—two varieties of which are now found in California, and nowhere else in the world,—are the southern cypress, found in the swamps and everglades of our Southern Atlantic States, and a similar tree of the cypress family, now found only in Northern China and Japan. A species of yew, the Torreya, has also a similar distribution, the members of its family being found only in the red-wood districts of California, in the swamps of Florida, and in Northern China. The old theory was that these trees were created, or originated in the neighborhood of their present habitats, thus constituting several independent stocks. Dr. Gray maintained, however, that these trees originated from a single stock, in Arctic Latitudes, when the climate was warmer and the continents were not separated as now by wide expanses of sea. By glacial action, or otherwise, they were pushed southward in different localities, and the hardiest, most adaptable stocks survived in the localities where they are now found. This theory, now generally accepted by botanists, was subsequently confirmed by the discovery of fossil red-wood trees in the Arctic regions.

Dr. Gray held that the doctrine of Evolution was compatible with the belief that Nature—the material universe—is the outcome of mind rather than that mind is the product of material conditions. He held that the whole process of organic evolution involved the idea of design, was an adaptation of means to ends. He did not think, however, that it was necessary for the believer in Christianity to assume the responsibility of attempting to harmonize evolution with the natural science of Genesis. "With the rise and development of astronomy, physics, geology, and later of biological science," he said, "the tables were turned; and now many religious beliefs—or what were taken for such—are controlled and modified by scientific beliefs, none more so than in the matter of 'Biblical Creation.' The result, I suppose, is that no sensible person now believes what the most sensible persons believed formerly." On the ground of natural science, he held, "Scientific belief must needs control the religious."* He thought, however, that modern natural science, in any of its demonstrated results or well-established beliefs, was not necessarily antagonistic to the Christian religion.

Dr. Janes also spoke of Dr. Gray's kindness of heart and friendship for children, mentioning some instances.

MR. JAMES A. SKILTON:—

The essay of the evening and its discussion by Miss Youmans have given me the unique experience of uniting the interest and enjoyment of this present moment with the remembered fascinations of a sort of pre-adamite or ante-deluvian age, speaking in regard to the evolution of botanical science.

It was my privilege, before I was half through my teens, in an interval of rest from over-study, and between the preparatory school and the university, to earn the degree of Bachelor of Natural Science in the first institution established in the United States for the especial study of Botany and the other Natural Sciences—and thereupon to practically almost abandon the further pursuit of those sciences; only taking them up again in the most general way as required from time to time while watching the development of the new science and philosophy since the publication of the "Origin of Species" in 1859. The botanical system taught in that institution was that of Linnæus. So it comes about that I am able to speak to you from personal experience and observations of the state of scientific knowledge as taught in the days before the coming of the flood of light which we are now enjoying, and also of one of the early teachers of Professor Gray, his life and methods.

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*Discussion before "Evangelical Alliance," Sept. 11, 1882.

In May, 1810, at Catskill, N. Y., Professor Amos Eaton, a graduate of Williams College of 1799, made, it is believed, the first attempt in this country to deliver a popular course of lectures on botany, compiling a small elementary treatise for the use of his class, in what he called "The Botanical Institution," the first botanical text-book in English published in this country; those previously used being in the Latin language. In 1817 he delivered lectures on botany, mineralogy and geology to volunteer classes of the students of Williams College, at Williamstown, Mass. The first edition of his Manual of Botany was published by graduates of Williams College in 1817, and gave a great impulse to the study of botany in New England and New York. The eighth and last edition of this work was published in 1840, under the title of "North American Botany," a large octavo volume of 625 pages, and containing descriptions of 5267 species of plants.

Between 1817 and 1834, Professor Eaton also delivered courses of lectures on branches of natural history, but particularly on botany, before the Members of the Legislature at Albany, on the special invitation of Governor De Witt Clinton; in the Lenox Academy, Mass.; at Northampton under the patronage of Governor Strong of Massachusetts; in the Medical College at Castleton, Vermont, in which he was appointed Professor of Natural History in 1820; in the City of Troy, N. Y., and in many other places. His lectures in Albany resulted in the initiation of that great work, "The Natural History of New York," the naturalists engaged in which were largely his pupils—among them James Hall and Ebenezer Emmons. That work has not only been the pattern for the scientific surveys of other States, but men who studied under him have been engaged in such surveys in many of the States. In 1818 he first published his "Index to the Geology of the Northern States," which was the first attempt at a general arrangement of the geological strata of North America. In 1818–19 the City of Troy—then little more than a village, but settled by the advance guard of that New England emigration which has since covered the Western States—had a Lyceum of Natural History and the most extensive collection of American geological specimens to be found in this country. With Albany, it contained a notable number of leaders in science. Among them were Professor Henry, the Becks, and many more, but in the early days Professor Eaton was easily the leader in all branches.

In 1824 Professor Eaton, by the aid of the Patroon, Stephen Van Rensselaer, of Albany—a man of broad views and public spirit—established in the City of Troy a School of Science then called the Rensselaer School, which eventually became a school of all branches of engineering, is now known as the Rensselaer Polytechnic Institute, was the model at some remove of the Brooklyn Polytechnic Institute, and has turned out, as its biographical record shows, a larger number of the successful working scientific men and engineers of our day and generation engaged in applying science in the work of the world than any other institution in the country, possibly more than all the literary colleges put together; among whose names are to be found those of the men who designed and built the Brooklyn Bridge, and of many others who are now engaged in the great engineering works of the country. From 1824 to May 6, 1842, the day of his death, Professor Eaton was at the head of this institution. And between 1810 and 1841 in addition to other labors, he wrote various works on botany, chemistry, zoology, geology, and kindred topics, to the number, including the different editions, of about forty publications in all.

His biography has never been more than sketched in outline, but it is to be doubted whether any single American has, through his work, his pupils, his methods, and the stimulus he directly gave to others, done more for the cause of science, and of combined science and practice in the United States, than Professor Eaton did. Neither, owing to circumstances which there is no time here to explain, has adequate justice been done to the methods by and through which he produced the marked effects to be traced to him, except in the minds of a few. Those methods, in a word, consisted in bringing the student into direct contact with the actual thing to be studied, in relegating the text-book to a secondary position, and in bringing the minds and hands of teacher and pupil into immediate co-operative relations. He divided his classes into sections of eight, with the most competent member as its captain or leader. The pupils assisted in preparing and arranging the objects and mechanisms to be employed, whereupon the Professor lectured to the entire class; in chemistry performing all the experiments, and in all the other branches going through with all the manipulations and illustrations with the actual objects in hand; whereupon the subject was taken up in turn by each section and by every member of each section, all of them, with the other members, constituting a critical audience, lecturing upon it in turn and going through all the necessary manipulations, experiments, demonstrations and illustrations. After the lecture on botany the class was usually dismissed with the direction to start for the fields with botanical cans, and incited to find and bring back the greatest possible number of new plants. Through the long list of years, I still vividly recall the eager joy of that work, and remember how, from hill-tops and other points of vantage, I planned botanical campaigns, studied typography, habitat and environment, and thereby sought to discover the hiding-places of particular plants we wished to capture; and how we scorned fatigue, obstacles and laggards in their pursuit. The students were expected on their return, after the first few lessons had been given, to find for themselves the genus and species of the plants they brought in. Where they found themselves puzzled and could not be helped out by their fellows, they were expected to rely upon the Professor for the names of genus and species.

The principle of the fixity of species was of course formally taught. But the total teaching—that is, the teaching of the Professors, the books, *and* that of the fields and the plants themselves included—resulted, not simply in the relaxing of our belief in it, nor simply in the acceptance of the convenient word "variation" as expressive of the actual differences found in specimens evidently of the same genus, but not answering to all the details of description given in the books for any particular species. Although a mere child I distinctly remember that notwithstanding the reiterated declarations of the Professors and of the text-books, my own mind would not accept the doctrine of the fixity of species. For, my experience was that in attempting to find the genus and the species of the plant in hand, the case was a rare and exceptional one where the entire description of any species would everywhere fit any specimen; and I well remember that when compelled to resort to the Professor—for that reason, and because I attempted to adhere to the principle of the fixity of species—something like heat, if not indignation, would flash through me when the Professor gave me a specific name over which I had long puzzled in vain and which I had perhaps rejected because of the defective description. From that time, the Summer of 1845, till the publication of the "Origin of Species," I carried a skeptical mind on the subject, and when that book was published, although I could only get access, in the South, through brief reviews, through the information contained in newspaper scraps, and—I may say—through orthodox sermons and their struggles with the "monkey problem," to what it contained, I promptly accepted the principle taught by Darwin in that book, basing that acceptance largely upon the facts of my long past experience, and upon the satisfactory explanation offered by him of my early difficulties in the study of botany. It is to be remembered, we had Lamarck, and the "Vestiges of Creation," and that discussion was active and had already undermined many old theories.

Further, in the home into which I was born, geological and palæontological specimens were everywhere and to a large extent the playthings of my childhood. The more recent tracing of the history of plant-life from fossil forms down to living forms by Professor Gray has been mentioned in the essay of the evening. Botany as well as geology and palæontology were constant topics in that household as far back as I can remember; and as early as 1845 certainly, probably before, I distinctly remember tracing the genus Equisetum back as far as its gigantic fossiliferous forms found in the Coal Measures. Perhaps I may be permitted to go a step further. By this time of day I suppose I am recognized in this Association as a thorough believer in Evolution as taught by both Darwin and Spencer. I first learned of Spencer by taking up one of his books of essays in a bookstore in Albany in the Winter of 1862–63, not long after Professor Youmans had brought about his introduction to America. Before the first page was finished my mind was caught. As I read on—still standing—I soon began to hear my mind saying: *Here he is at last—the thinker, philosopher and leader for whom I have looked so long in vain!* Seeing other books bearing his name on the same table, I rapidly glanced through them, and soon found the programme of the system of Philosophy he was to write and the list of what he had already written. Among these was the title of his essay on Population, printed in a *Westminster Review* of 1852. Being myself already an anti-Malthusian, I immediately concluded that an examination of that essay would establish his position as a thinker, for me. It was not yet an hour since I had picked up the essays. Proceeding directly to the State Library I obtained the copy of the *Review*, and found my hopes and expectations confirmed in the first sentence. From that day I have been an earnest Spencerian. And that I have been so, I believe is due primarily to Professor Eaton, to the Rensselaer Institute established by him, to Professor George H. Cook, now of New Jersey, his successor, to the Troy Lyceum, to my own father, who was my constant teacher in natural and biological science, and to the combination of all these that had been brought to bear upon me as early as the Summer of 1845, if not before, and certainly before the work of Professor Gray had much of it been done or become much known.

From these statements it will appear that the ideas now dominant in the scientific world, as to the unfixity of species, were in the air, or coming, so to speak, long before Darwin or Gray had either written, published or reached their final conclusions. While, then, I would not minify the magnificent achievements of such men as Darwin, Gray, and other modern lights, I do not believe it just, and for myself I do not propose, to be guilty of ignoring the laborious workers in natural science, in this country, on whose work recent builders have built as upon a foundation. Now when we are celebrating the praises of Professor Gray, I ask you not to forget the labors of such pioneers as Professor Amos Eaton. Mrs. Treat says, you will remember, that after reading the article in the "Edinburgh Encyclopedia," it was Eaton's Botany he first obtained and studied with interest, and that by its aid the little Claytonia Virginica was the first treasure he captured and identified in the early Spring. How many of us can understand and enter into his earnest welcome of that cheerful flower!

I am glad to be able to say that in an early number the *Popular Science Monthly* will do for Professor Eaton what it has done for so many other scientific men, in preserving their names and labors from threatened oblivion.

Doubtless, if Professor Gray could have been with us to-night he would have stood in my place to say, much better than I have done or can do, words of cordial recognition and appreciation on behalf of his old teacher, Professor Amos Eaton.

MR. WILLIAM POTTS :—

I desire merely to take this occasion to emphasize the fact, so well illustrated by the experience of Dr. Gray, that the minute and scientific study of botany in no way interferes with the natural love of flowers and plants for their beauty. On the contrary, the more we know about flowers, the more we study them scientifically, the more we love them and appreciate their beauty. The contrary idea, sometimes expressed by those ignorant of the facts, is entirely false, and should be condemned by us.

DR. ROBERT G. ECCLES :—

Dr. Eccles said he had first been introduced to Professor Gray about ten years ago, by Professor E. L. Youmans, in D. Appleton & Co.'s office. His last meeting with him was at McGill College, Montreal, during the meetings of the American Association for the Advancement of Science. On an excursion to Ottawa at the same time a favorable opportunity was presented of studying Professor Gray's disposition and learning from him how he harmonized his religion with evolution. At several points visited all the guests were asked to register. While men with one title invariably affixed that to their names, Professor Gray with characteristic modesty signed his name simply "Asa Gray," although he could almost have filled the page with the initials of his honorary and other degrees as well as those of the learned Societies to which he belonged.

When questioned in the most elementary facts of botany by people not familiar with that science, he would patiently explain the matter to them with evident pleasure. The contrast between him and a number of other prominent members of the Association, who had been seen by Dr. Eccles snubbing honest but ill-posted inquirers after facts, was pronounced and startling. During the trip to Ottawa he disclosed how he reconciled his Presbyterianism and Evolution, the subject being raised by reference to a discussion on Darwinism the day preceding in the Biological Section. He pointed out that in the growth of a plant or tree from its seed to full maturity a struggle for existence among its cells, buds, leaves, branches, flowers, etc., is incessantly going on. In spite of this warfare every seed produces a tree or herb after its kind. Like playing with loaded dice that must turn up the proper sides every time in spite of shaking, in the molecular warfare the winning party is invariably pre-destined in its very structure. In the warfare among organisms and in society the same conditions are found. "Fitness" may be diabolical, or it may be beneficent. Somehow in the great average it always comes out beneficent. Evolution is God's will made manifest in matter. The side championed by right and good always wins in the end.

Dr. Gray was a most voluminous writer. A list of the titles and headings of his books and magazine contributions has been published, and forms a pretty large octavo volume in itself. Darwin was indebted for much, and perhaps for a majority of his most telling botanical facts, to Dr. Gray. A great deal of the material in his "Climbing Plants," was the work of the latter. The Compositæ are the most difficult plants a botanist can study. Here Gray was monarch and peerless. In his contributions to plant distribution he showed himself at once a master botanist, a philosopher and a naturalist. Others had walked blindly over the same facts and fields and did not see that every flower told the tale of its own past history, and the history of its kind, by the place where it is found. Where plants of a common or kindred kind are now, tells of their past wanderings when the facts are all considered. Dr. Gray made this discovery. To Gray Darwin first imparted his idea of Natural Selection. Dr. Eccles thought it strange that the essayist of the evening forgot to mention this, the most important fact in a course of lectures on Evolution in connection with his life. Especially important is it because of its bearings on the history of the doctrine of Natural Selection. Darwin and Wallace each claimed priority in advocating this principle, and these rival claims were forever set to rest by a letter from Darwin to Gray that was read at a meeting of the Linnæan Society when the two champions first gave forth their ideas publicly. This was on July 1st, 1858. Darwin's letter was written a year before. But even this celebrated epistle was not the first. On July 20th, 1856, Darwin wrote to Gray:—

> "I have come to the heterodox conclusion that there are no such things as independently created species, that species are only strongly defined varieties. . . . I assume that species arise like our domestic varieties with *much* extinction."

This is the first word ever known to have been penned in this world on the now well-known principle of "survival of the fittest."

While Gray treated this doctrine fairly from the first, it was not to be expected that he would immediately give adherence thereto. His friends, Agassiz and Dana, bitterly opposed it, while he held his mind in the true scientific attitude of suspended judgment. His heart from the first told him there must be something in it. In 1880 he had so far transcended his scruples that at New Haven he publicly said: "Natural selection by itself is not a hypothesis nor even a theory. It is a truth, a *catena* of facts and direct inferences from facts." It is a sad pity that he did not live to complete some of the work he had begun. The "Synoptic Flora" lies incomplete, to the sorrow of many a botanist

At the banquet on his seventy-fifth birthday, when the silver vase was presented to him, every botanist in America felt that, like the great Rocky Mountain peak bearing his name, here was one who transcended them all in the knowledge of their favorite Science. It was then Lowell wrote of him:

"Just fate! prolong his life, well spent,
Whose indefatigable hours
Have been as gaily innocent
And fragrant as his flowers."

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